

Consolidated Systems Gateway Services CSCI

Requirements and Design Review

Thor Design Panel 2

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1. Consolidated Systems Gateway Services CSCI

1.1 Consolidated Systems Gateway Services Introduction

1.1.1 Consolidated Systems Gateway Services Overview

The Consolidated Systems (CS) Gateway Services CSCI provides the functionality required to receive and process Integrated Vehicle Health Management (IVHM) Human Exploration and Development of Space (HEDS) Technology Demonstration 1 (HTD-1) data, Ground Measurement System (GMS) data, and Pad Meteorological (Metro) data. This CSCI also provides the functionality required to receive and route HTD commands. The CS Gateway CSCI resides on the Front End Processor Controller within the CS gateway, as shown in Figure 1. The CSCI interfaces to the HTD via the LON when the orbiter is in the OPF or via the T-0 interface when the orbiter is at the Pad. The CSCI interfaces to the CSDS Gateway via the LON to receive GMS and Metro data and to transmit HTD Merge data. The CSCI also interfaces to the RTCN to transmit HTD, GMS, and Metro data to the remainder of CLCS through the GCP Services API which is part of the Common Gateway Services CSCI. HTD requirements will be met by the CS Gateway for the Thor delivery. If time permits, GMS and Metro requirements will also be incorporated in Thor, otherwise, they will be deferred until the Atlas delivery. Note: GMS & Metro data are currently available via the Test Data Generator.

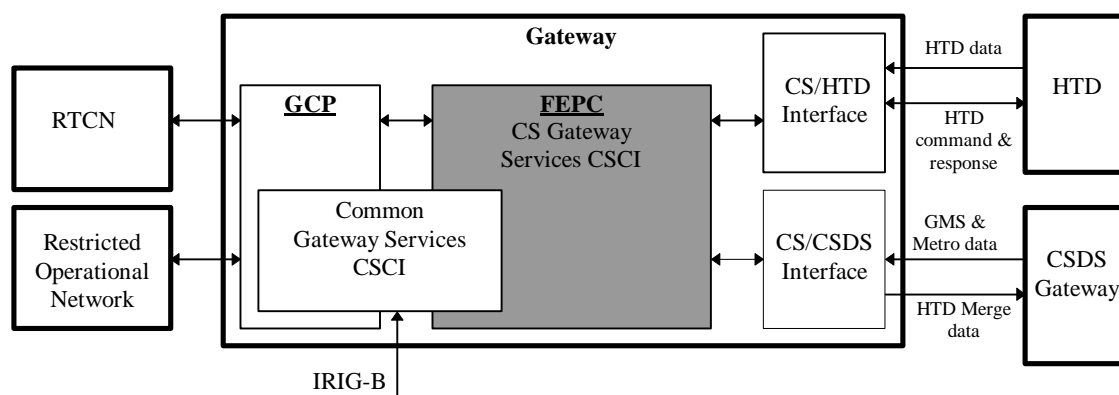


Figure 1. CS Gateway Interfaces

1.1.2 CS Gateway Services CSCI Groundrules

- Redundancy / Switchover will not be provided in the Thor delivery
- If time permits, GMS and Metro requirements will also be incorporated in Thor, otherwise, they will be deferred until the Atlas delivery.

1.1.3 CS Gateway Services CSCI Dependencies

- Table Builds
- Common Gateway Services

1.1.4 CS Gateway CSCs

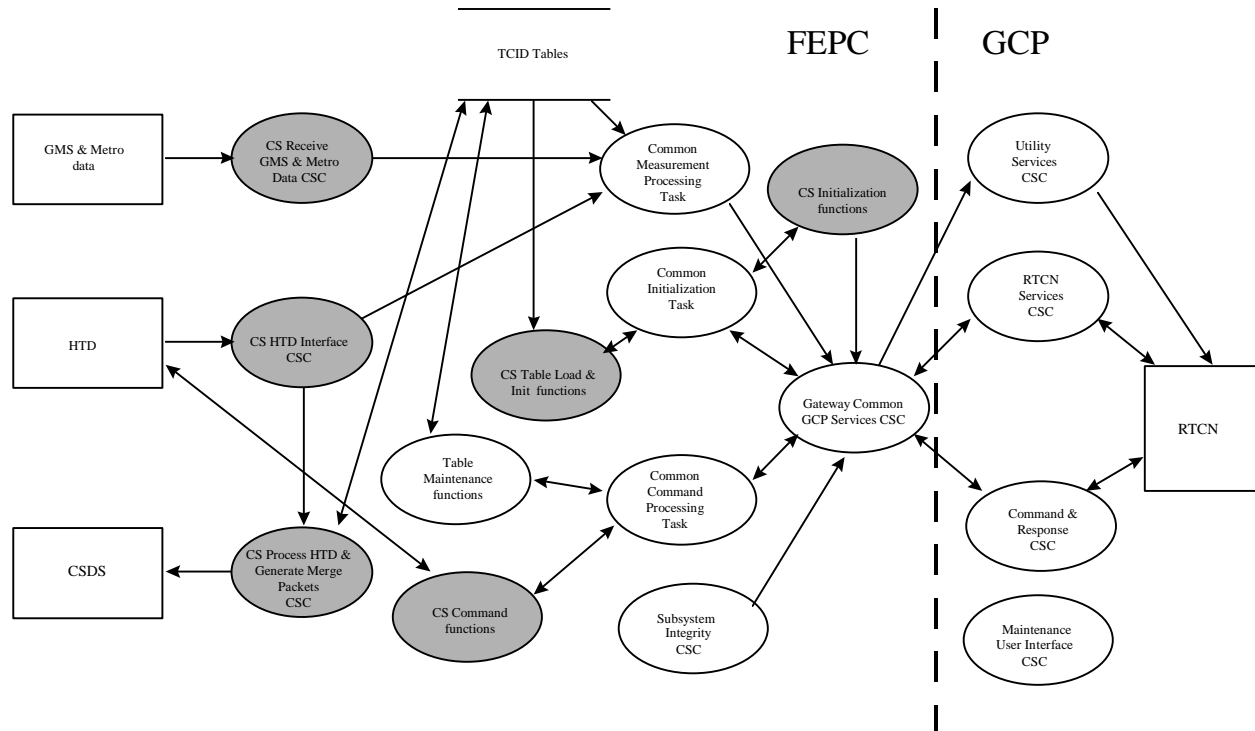


Figure 2. CS Gateway CSCs

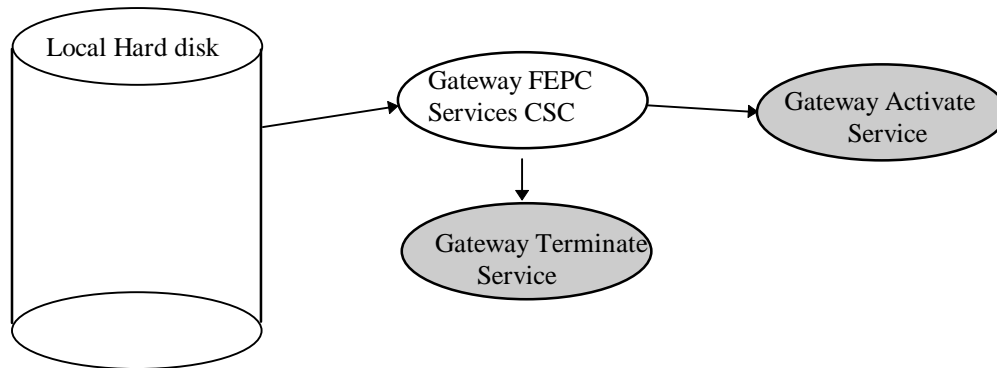
Figure 2 shows the CS Gateway CSCs (shaded) along with the Common Gateway Services (unshaded). The requirements for each CS Gateway CSC will be addressed in a separate section of this document. The CS Gateway CSCs are CS Initialization, CS Table Load & Initialization, CS Receive GMS & Metro Data, CS HTD Interface, CS Generate HTD Merge Packets, and CS Command Processor.

2. CS INITIALIZATION CSC

2.1 CS INITIALIZATION CSC Introduction

2.1.1 CS Initialization CSC Overview

The CS Initialization CSC is responsible for performing initialization and termination which is unique to the CS Front End Processor Controller (FEPC) card within the CS gateway. This CSC provides the activate and terminate functions required by the Gateway FEPC Services CSC during FEPC initialization.



2.1.2 CS Initialization CSC Operational Description

During FEPC initialization, the CS Initialization CSC provides the activate and terminate functions required by the Gateway FEPC Services CSC. The activate function performs specific activation of CS tasks supporting: Measurement Processing, Command Processing, and Interface Configuration. The terminate function sends a terminate signal causing all CS unique tasks to terminate gracefully to allow the FEPC to return to Ready mode.

2.2 CS INITIALIZATION CSC Specifications

2.2.1 CS Initialization CSC Groundrules

- The Gateway GCP Services API, Gateway Subsystem Integrity and FEPC Services CSC's are implemented under the Gateway Common Service CSCI.

2.2.2 CS Initialization CSC Functional Requirements

1. CS FEPC Initialization

- 1.1. The CS Initialization shall provide the capability to perform CS unique CSC's activation as part of activate command.
- 1.2. The CS Initialization shall record all initialization messages on local storage media.
- 1.3. The CS Initialization shall generate a system message due to an error.

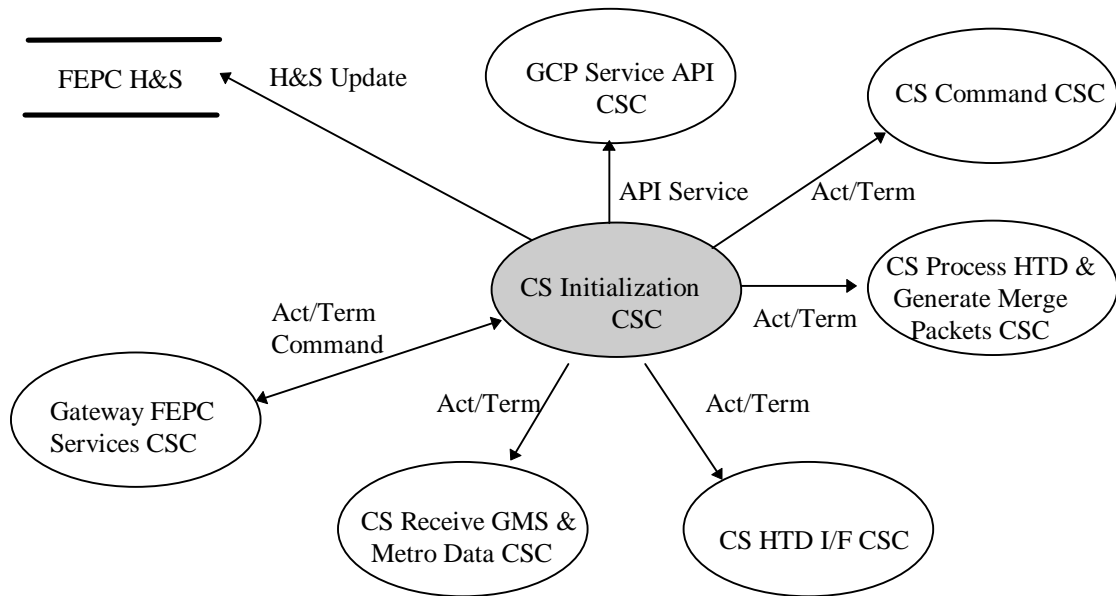
2. CS FEPC Termination

- 2.1. The CS Initialization shall accept and process a request to terminate (Terminate Gateway) the subsystem only when data acquisition is inhibited.
- 2.2. The CS Initialization shall update status information during termination of subsystem processing.
- 2.3. The CS Initialization shall record all termination messages on local storage media.
- 2.4. The CS Initialization shall generate a system message prior to self termination of subsystem processing.

2.2.3 CS Initialization CSC Performance Requirements

No performance requirements have been identified for this CSC for the Thor delivery.

2.2.4 CS Initialization CSC Interface Data Flow Diagrams



The CS Initialization CSC provides activate and terminate functions which are called as part of the FEPC Initialization. An activate function is provided by this CSC to spawn CS unique tasks when transitioning to Operational mode. A terminate function is also provided to terminate CS unique tasks gracefully. The CS Initialization will update health and status information if required.

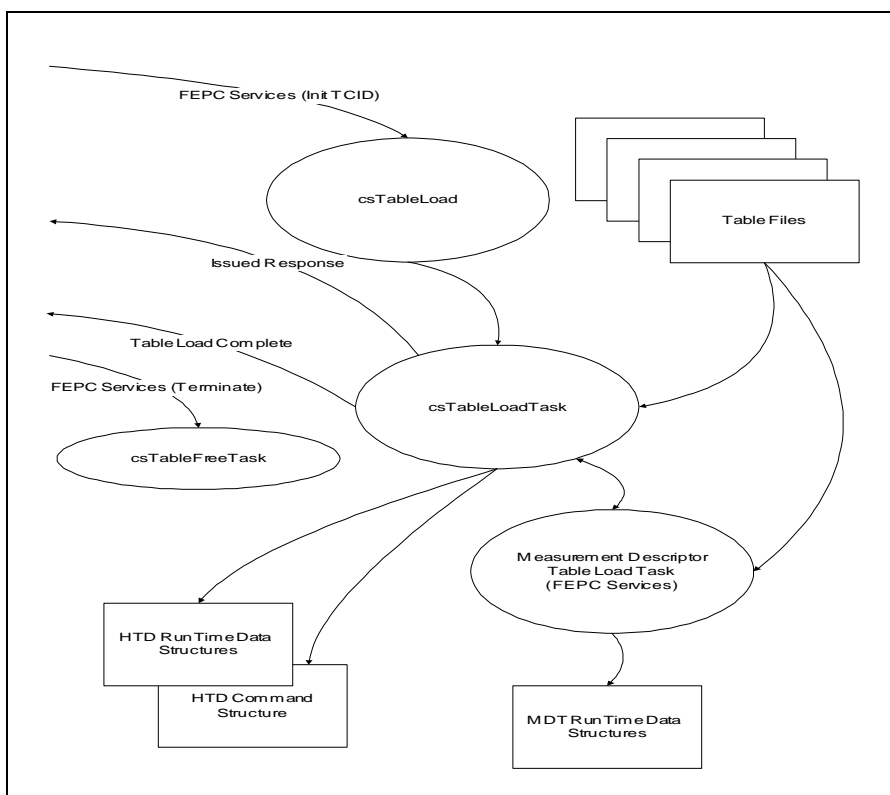
3. CS Table Load and Initialization CSC

3.1 CS Table Load and Initialization CSC Introduction

3.1.1 CS Table Load and Initialization CSC Overview

The CS Table Load and Initialization CSC is part of the CS Gateway Services CSCI. The CSC is responsible for loading the TCID tables from the hard drive into memory and verifying their content.

3.1.2 Data Flow Diagram



3.1.3 CS Table Load and Initialization CSC Operational Description

The CS Table Load and Initialization CSC is commanded to load the CS unique TCID tables from the local hard drive by the FEPC Services CSC in response to an Init TCID command. The TCID files to be loaded are the Format Descriptor Tables, the Measurement List, and the Measurement Descriptor Tables. The CS Table Load and Initialization CSC will open the file, obtain the number of records, allocate memory based on the record count, use the `fscanf()` function to read each record and then verify that the expected number of entries are present. The internal data structures will then be built and populated.

3.2 CS Table Load and Initialization CSC Specifications

3.2.1 CS Table Load and Initialization CSC Groundrules

1. System software and TCID tables will be resident on the local hard drive.
2. System software will be loaded from the local hard drive during power up and on command (Initialize SCID or reboot).
3. TCID tables will be loaded when an initialize TCID command is received.
4. The following tables will be provided by build as part of the TCID information at load / initialization time:
 - 4.1. HTD Format Descriptor Tables
 - 4.2. HTD Measurement List
 - 4.3. Measurement Descriptor Tables
5. The Gateway GCP Services API, Gateway Subsystem Integrity and FEPC Services CSC's are implemented under the Gateway Common Service CSCI.

3.2.2 CS Table Load and Initialization CSC Functional Requirements

1. CS Table Load and Initialization CSC shall load all required TCID tables from the local hard drive when the Initialize TCID command is received.
2. CS Table Load and Initialization CSC shall respond to the Initialize TCID command with a success or fail status.
3. CS Table Load and Initialization CSC shall perform the following verification checks on the loaded tables.
 - 3.1. Correct entries per record will be checked.
 - 3.2. EU coefficients which are used by the CMDT will be tested to ensure at least a first order polynomial is present.

3.2.3 CS Table Load and Initialization CSC Performance Requirements

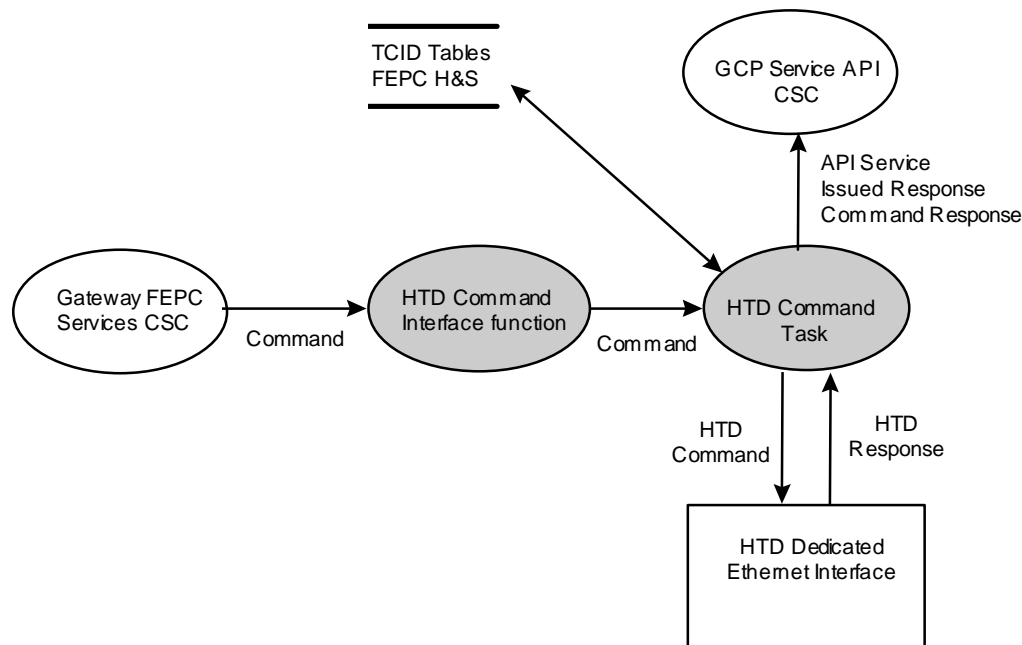
No performance requirements have been identified for this CSC for the Thor delivery.

4. CS Command Processor CSC

4.1 CS Command Processor CSC Introduction

4.1.1 CS Command Processor CSC Overview

The CS Command Processor CSC is part of the CS Gateway Services CSCI. The CSC is responsible for interpreting and controlling the execution of all commands received by the CS Gateway CSCI.



4.1.2 CS Command Processor CSC Operational Description

The CS Command Processor CSC receives commands from the FEPC Common Command CSC, builds the HTD command packet, and sends it to the HTD Interface CSC. The Command Processor receives the Command Response from the HTD Interface CSC, builds the RTCN response packet, and sends it to the FEPC Common Command Processor.

4.2 CS Command Processor CSC Specifications

4.2.1 CS Command Processor CSC Groundrules

- Redundancy / switchover commands are not supported for Thor.
- The Gateway GCP Services API, Gateway Subsystem Integrity and FEPC Services CSC's are implemented under the Gateway Common Service CSCI.

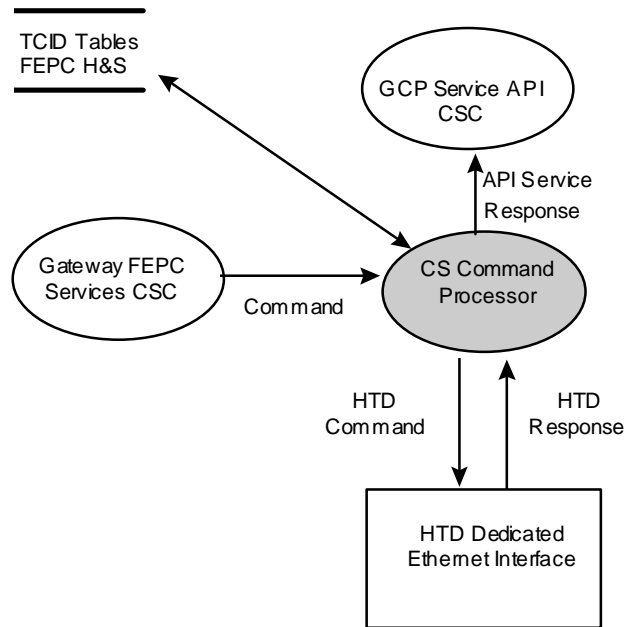
4.2.2 CS Command Processor CSC Functional Requirements

- 1 CS Command Processor shall receive all commands from the Gateway Common Services CSCI using the FEPC Command Processor.
- 2 CS Command Processor shall translate the FDID to the corresponding ASCII character.
- 3 CS Command Processor shall build the HTD command packet.
- 4 CS Command Processor shall send the HTD command packet to the HTD via Dedicated Ethernet.
- 5 CS Command Processor shall support the Issue (digital pattern FD's) operational command.
- 6 CS Command Processor shall receive the command response from the HTD via Dedicated Ethernet.
- 7 CS Command Processor shall build the RTCN command response packet.
- 8 CS Command Processor shall send the HTD command response packet to the FEPC Common Command Processor.
- 9 The completion code for the issue command response shall contain one of the following:
 - 9.1 Successful
 - 9.2 Invalid FDID
 - 9.3 HTD Time-out
- 10 CS Command Processor shall be capable of generating system messages through the Gateway Common Services CSCI using the GCP Services API.
- 11 CS Command Processor shall be capable of requesting through the GCP Services API that a message be written to a file on the local hard drive or the local console port.

4.2.3 CS Command Processor CSC Performance Requirements

No performance requirements have been identified for this CSC for the Thor delivery.

4.2.4 CS Command Processor CSC Data Flow Diagram



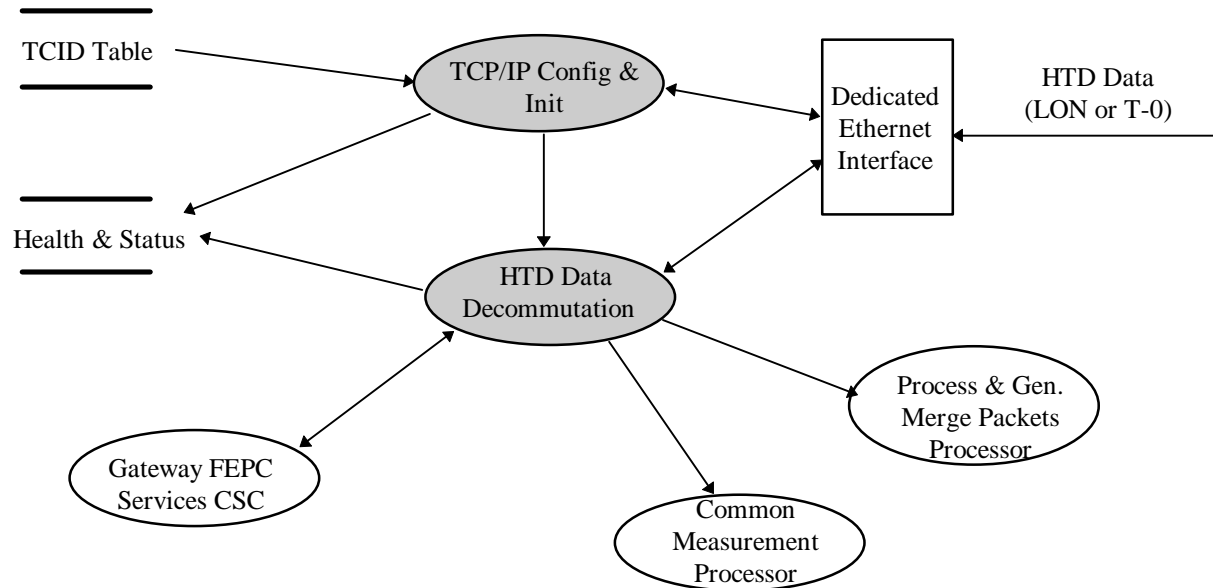
The CS Command Processor CSC will interface with the FEPC Common Command Processor CSC to get commands from and send responses to the CCWS via GCP Common Services. The Command Processor CSC will send HTD commands to and receive HTD responses from the HTD via Dedicated Ethernet.

5. CS HTD Interface CSC

5.1 CS HDT Interface CSC Introduction

5.1.1 CS HDT Interface CSC Overview

The CS HDT Interface CSC is responsible for interfacing with HTD via Dedicated Ethernet Communication to receive HTD measurement data and transmit HTD commands.



5.1.2 CS HTD Interface CSC Operational Description

The CS HTD Interface CSC extracts HTD Measurement Data from the input Ethernet socket and forwards the data to the Common Measurement Processing CSC which processes the data and generates change data packets to placed on the RTCN for the remainder of CLCS. The CS HTD Interface CSC also forwards the HTD Data to the CS Process & Generate Merge Packets CSC which converts the data to Engineering Units and generates HTD merge packets to be sent to the CSDS Gateway.

5.2 CS HTD Interface CSC Specifications

5.2.1 CS HTD Interface CSC Groundrules

- The Gateway GCP Services API, Gateway Subsystem Integrity and FEPC Services CSC's are implemented under the Gateway Common Service CSCI.
- TCID tables must be loaded to the FEPC's memory prior to Activate Data Acquisition.

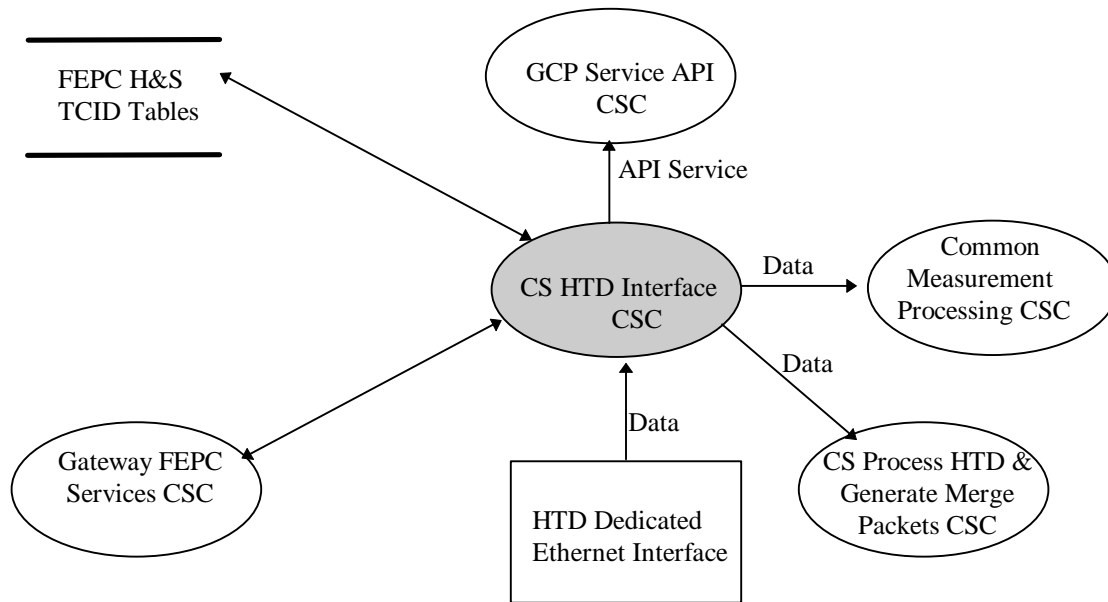
5.2.2 CS HTD Interface CSC Functional Requirements

- 1.1 The CS HTD Interface shall process requests to Activate/Inhibit Data Acquisition.
- 1.2 The CS HTD Interface shall provide stream-oriented (TCP) interface capability to communicate with the HTD.
- 1.3 The CS HTD Interface shall issue a system message and update the Health and Status if it fails to connect to the HTD during network initialization.
- 1.4 Once connected, the CS HTD Interface shall provide the capability to detect a valid Start Marker word and its End Marker word.
- 1.5 The CS HTD Interface shall issue a system message and update the Health and Status if an invalid End Marker is detected.
- 1.6 The CS HTD Interface shall issue a system message and update the Health and Status if an invalid frame ID word is detected.
- 1.7 The CS HTD Interface shall Block Log raw data when detecting an invalid frame ID or an invalid End Marker.
- 1.8 The CS HTD Interface shall issue a system message when the CS Gateway processing is exceeded.
- 1.9 The CS HTD Interface shall Block Log raw data when the CS Gateway processing is exceeded.

5.2.3 CS HTD Interface CSC Performance Requirements

No performance requirements have been identified for this CSC for the Thor delivery.

5.2.4 CS HTD Interface CSC Interface Data Flow Diagrams



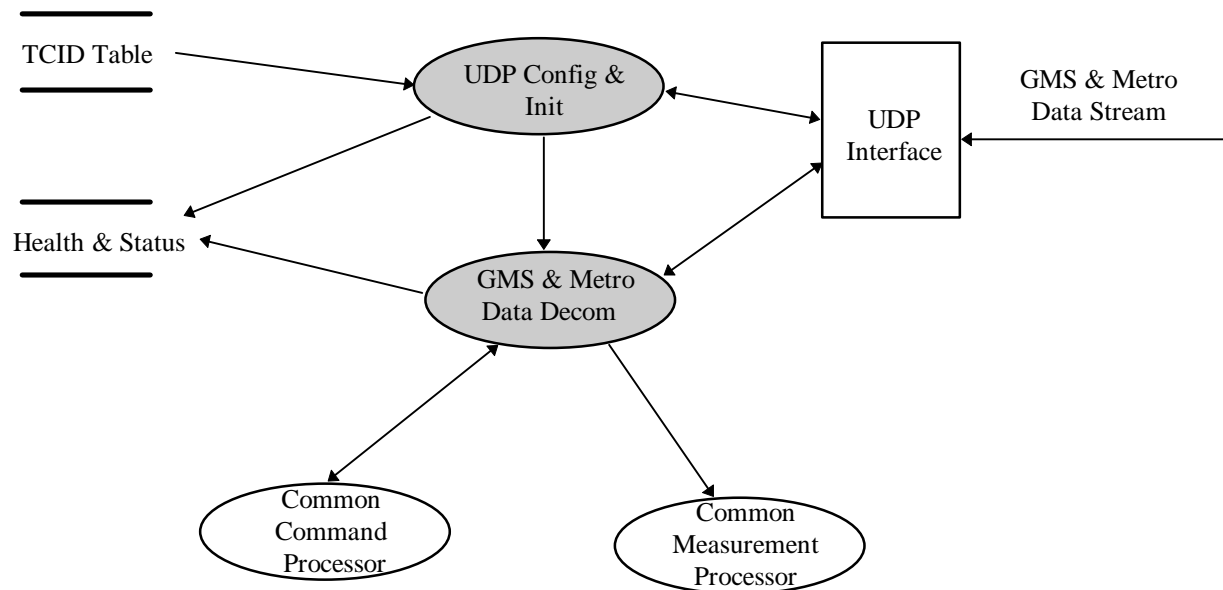
The CS HTD Interface CSC is responsible for initializing the communication with the HTD using stream-oriented (TCP) sockets. This CSC processes requests from the Common Command Processor to setup Ethernet interface as well as to start and stop data acquisition. HTD data is extracted based on TCID tables which are loaded by the CS Table Load and Initialization CSC. Extracted data along with its MDT index will be sent to the Common Measurement Processing CSC which processes the data and generates change data packets to be placed on the RTCN. Also extracted data will be sent to the CS Process & Generate Merge Packets CSC which converts the data to Engineering Units and generates HTD merge packets to be sent to the CSDS Gateway. HTD Commands received from the CCWS will be processed and sent to the HTD.

6. CS RECEIVE GMS & METRO DATA CSC

6.1 CS RECEIVE GMS & METRO DATA CSC Introduction

6.1.1 CS Receive GMS & Metro Data CSC Overview

The CS Receive GMS & Metro Data CSC is responsible for interfacing with the CSDS Gateway via Ethernet to receive raw GMS & Metro Data. The CSC forwards the data to the Common Measurement Processing CSC which processes the data and generates change data packets to be placed on the RTCN for the remainder of CLCS.



6.1.2 CS Receive GMS & Metro Data CSC Operational Description

The CS Receive GMS & Metro Data CSC is responsible for interfacing with the CSDS Gateway via Ethernet to receive raw GMS & Metro Data. The CSC forwards the data to the Common Measurement Processing CSC which processes the data and generates change data packets to be placed on the RTCN for the remainder of CLCS.

6.2 CS Receive GMS & Metro Data CSC Specifications

6.2.1 CS Receive GMS & Metro Data CSC Groundrules

- The Gateway GCP Services API, Gateway Subsystem Integrity and FEPC Services CSC's are implemented under the Gateway Common Service CSCI.

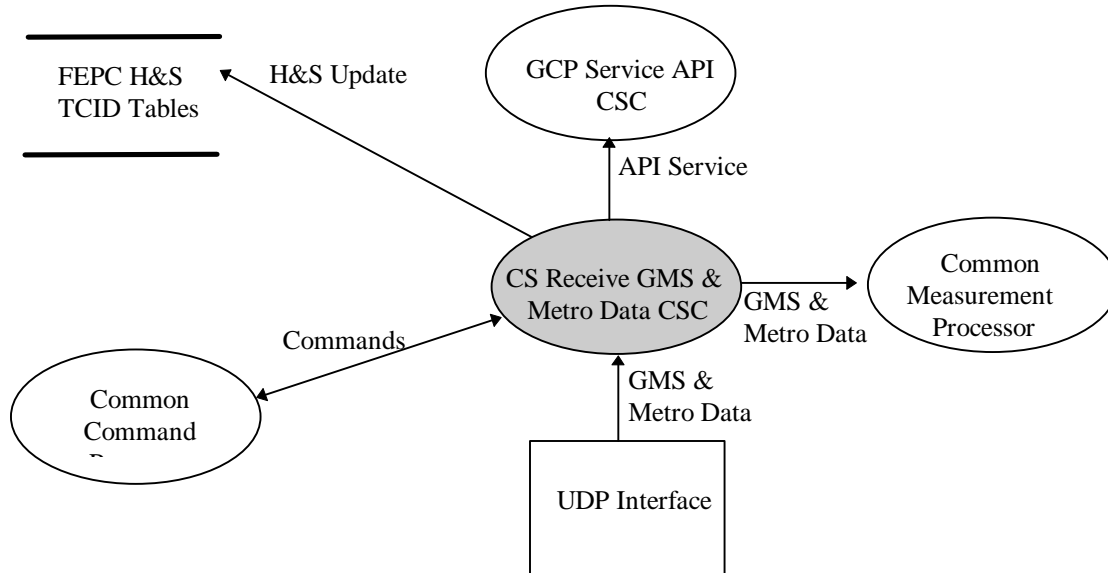
6.2.2 CS Receive GMS & Metro Data CSC Functional Requirements

- 1.1 The Receive GMS & Metro Data shall provide User Datagram Protocol (UDP) interface capability to receive raw GMS & Metro data from the CSDS Gateway.
- 1.2 The Receive GMS & Metro Data shall issue a system message and update the Health and Status if it fails to initialize an UDP socket.
- 1.3 The Receive GMS & Metro Data shall issue a system message and update the Health and Status if an invalid site ID from Metro data is detected.
- 1.4 The Receive GMS & Metro Data shall issue a system message when the CS Gateway processing is exceeded.
- 1.5 The Receive GMS & Metro Data shall Block Log raw data when the CS Gateway processing is exceeded.

6.2.3 CS Receive GMS & Metro Data CSC Performance Requirements

No performance requirements have been identified for this CSC for the Thor delivery.

6.2.4 CS Receive GMS & Metro Data CSC Interface Data Flow Diagrams



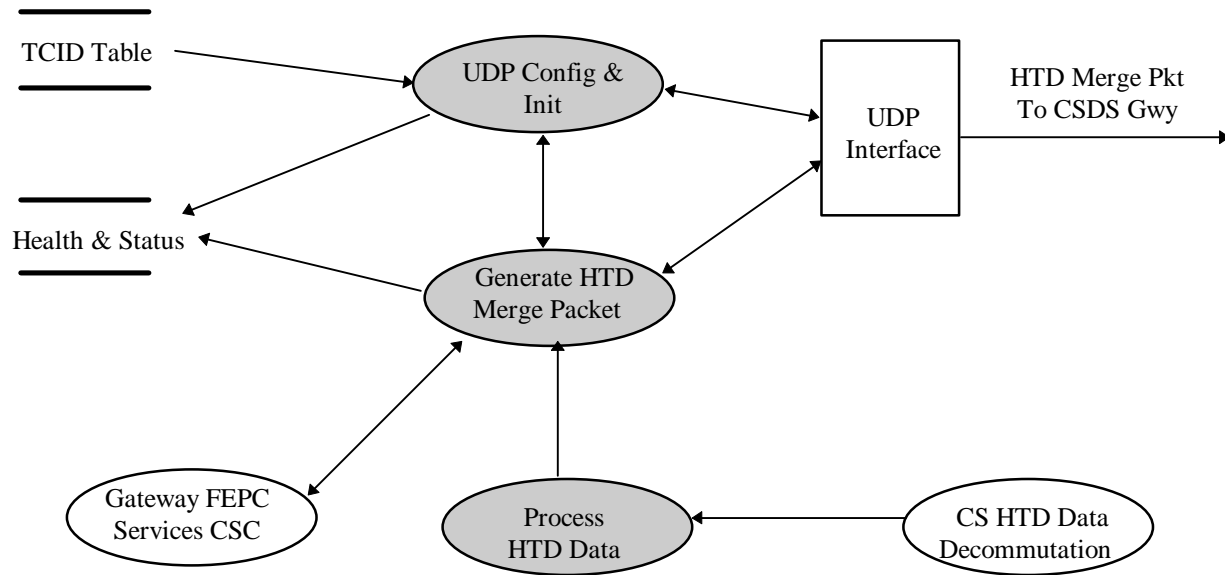
The CS Receive GMS & Metro Data CSC is responsible for initializing a UDP socket to receive raw GMS and Metro data from the CSDS Gateway. This CSC processes requests from the Common Command Processor to setup the UDP interface as well as to start and stop data acquisition. GMS and Metro data are extracted based on TCID tables which are loaded by the CS Table Load and Initialization CSC. Extracted data along with its MDT index will be sent to the Common Measurement Processing CSC which processes the data and generates change data packets to be placed on the RTCN.

7. CS Process HTD and Generate Merge Packets CSC

7.1 CS Process HTD and Generate Merge Packets CSC Introduction

7.1.1 CS Process HTD and Generate Merge Packets CSC Overview

The Process HTD and Generate Merge Packets CSC converts HTD data to Engineering Units. This CSC then generates and transmits HTD Merge packets, via a UDP socket, to the CSDS Gateway to be merged into the SDS' stream.



7.1.2 CS Process HTD and Generate Merge Packets CSC Operational Description

The CS Process HTD and Generate Merge Packets CSC receives HTD Measurement Data from the HTD Data Decommutation Task. The CS Process HTD and Generate Merge Packets CSC converts the data to Engineering Units, generates HTD merge packets, and sends the merge packets to the CSDS Gateway via UDP.

7.2 CS Process HTD and Generate Merge Packets CSC Specifications

7.2.1 CS Process HTD and Generate Merge Packets CSC Groundrules

- The Gateway GCP Services API, Gateway Subsystem Integrity and FEPC Services CSC's are implemented under the Gateway Common Service CSCI.

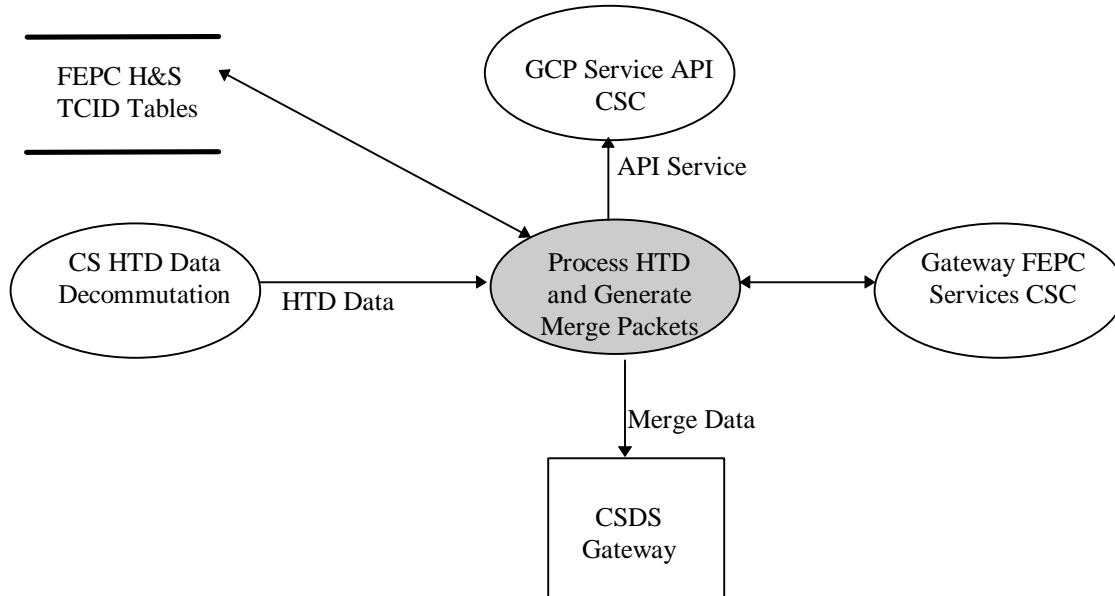
7.2.2 CS Process HTD and Generate Merge Packets CSC Functional Requirements

- 1.1 The CS Process HTD and Generate Merge Packets shall receive HTD data from the HTD decommutation task.
- 1.2 The CS Process HTD and Generate Merge Packets shall convert HTD data to Engineering Units.
- 1.3 The CS Process HTD and Generate Merge Packets shall generate HTD Merge Packets.
- 1.4 The CS Process HTD and Generate Merge Packets shall provide User Datagram Protocol (UDP) interface capability to transmit HTD merge packets to the CSDS Gateway.
- 1.5 The CS Process HTD and Generate Merge Packets shall issue a system message and update the Health and Status if it fails to initialize an UDP socket.
- 1.6 The CS Process HTD and Generate Merge Packets shall issue a system message and update the Health and Status if TCID tables are not loaded.

7.2.3 CS Process HTD and Generate Merge Packets CSC Performance Requirements

No performance requirements have been identified for this CSC for the Thor delivery.

7.2.4 CS Process HTD and Generate Merge Packets CSC Interface Data Flow Diagrams



The CS Process HTD and Generate Merge Packet CSC is responsible for initializing the communication with the CSDS Gateway via a UDP socket. This CSC processes requests from the Common Command Processor to setup the Ethernet interface as well as to start and stop data acquisition. HTD data is processed based on TCID tables which are loaded by the CS Table Load and Initialization CSC. The HTD merge packets are generated then transmitted to the CSDS Gateway via Dedicated Ethernet.